

## POLYURETHANE-BASED NANOCOMPOSITE FOR BIOMEDICAL APPLICATION

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### Abstract

*Hydrogels have emerged as promising materials in regenerative medicine due to their biocompatibility and tunable properties. Polyurethane (PU), a versatile polymer, is renowned for its excellent mechanical properties and stability. However, its inherent hydrophobicity limits its application in biomedical fields. To overcome this limitation, polyurethane hydrogels were synthesized by incorporating hydrophilic poly(ethylene oxide) (PEO) segments into the polymer backbone. Additionally, multiwalled carbon nanotubes (MWCNTs) were incorporated as nanofillers to further enhance the mechanical and electrical properties of the hydrogel matrix. The amount of MWCNT was 0.5; 1, 2 and 5 wt%. The synthesis was conducted via a step-growth polymerization reaction between poly[(phenyl isocyanate)-co-formaldehyde] and poly(ethylene oxide) (PEO) with a molecular weight of 10,000 g/mol, using dibutyltin dilaurate as a catalyst. The structure and properties of the resulting hydrogels were characterized using Fourier Transform Infrared Spectroscopy (FTIR), Raman spectroscopy, Differential Scanning Calorimetry (DSC), Scanning Electron Microscopy (SEM), and Transmission Electron Microscopy (TEM). FTIR analysis confirmed the successful formation of polyurethane linkages, while Raman spectroscopy provided evidence of the presence of MWCNTs within the hydrogel matrix. DSC results indicated a decrease in the melting temperature of the PEO segments with increasing MWCNT content, suggesting a disruption of the PEO crystallinity. SEM and TEM images revealed a uniform dispersion of MWCNTs within the hydrogel network and a porous microstructure. MWCNT addition resulted in decreased swelling due to increased crosslinking. These materials hold great potential for applications in various biomedical fields, including tissue engineering and drug delivery.*

**Keywords:** *polyurethane hydrogels, MWCNT, porosity of hydrogels, TEM analyse*